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| 14. ABSTRACT This report results from a contract tasking Astrophysikalisches Institut Potsdam (AIP) as follows: The contractor will investigate the discrimination among particle populations accelerated by reconnection or by different kinds of shock waves in the solar corona and the solar wind. This research will involve both data collection using a 40-800 MHz radar and analytical study of the collected data. | | | | | |
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FINAL REPORT

Contract Order No.

F61775-01-WE094

Title of Proposal:

Upgrade of the Aerial Guidance System for automatic high time and spectral resolution solar radio observations at the Astrophysical Institute Potsdam

Short title:

AGS Upgrade at AIP

Start date:

1 January 2002

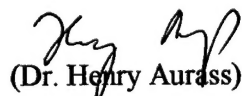
Duration of proposed efforts:

12 months

End date

1 December 2003

Potsdam, 01 Dec., 2003


(Dr. Henry Aurass)

- Principal Investigator -

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Introduction

Between the Air Force Geophysics Research Lab (AFGRL) and the Astrophysikalisches Institut Potsdam (AIP) there is a common research interest on the discrimination between particle species accelerated by (flare) magnetic field reconnection, and another particle species energized during the CME formation and propagation.

During the cooperative scientific work between both institutions it became clear that the AIP radio spectral observations in Central Europe are an important and necessary part of the world wide solar activity patrol network. This concerns radio spectral observations on a high standard, and with regular scientifically founded data publication in NOAA Solar Geophysical Data. Due to budget cuts it was impossible to save the high and regular time coverage of the observations after the observatory service had to be changed into a fully automatic regime.

It was the subject of the given (first AFGRL-AIP) EOARD-supported project to upgrade the mechanics and electronics of the AIP observatory's solar radio spectrometer aerial guiding system. This became urgent to avoid rising interruption intervals of the regular observations, and thus missing reports to NOAA Solar Geophysical Data.

Today we can state that this work is successfully completed.

Description of the work and results

In the Trensorf Observatory of Solar Radio Astronomy of the AIP, situated in the surroundings of Potsdam town 15 km away of the main institutes site, three parabolic dishes (10.5 and twice 7.5 m diameter) and a twin crossed-log periodic Yagi are used to observe the solar radio burst emission in the frequency range between 40 and 800 MHz (see <http://www.aip.de/groups/osra/spectra/> for the new online view on the solar radio spectra). There, solar radio burst patrol observations are carried out automatically with a remote control system.

As reported in detail in the first and second interim reports the project intention was an improvement of the aerial guiding system by changing the drive engines of the hour angle and the rectascension axle, a simplification and unification of the mechanical system, and a stabilization and improvement of the electronic control unit as well as the corresponding computer software.

The work consisted in a mechanical and electro-mechanical part, an electronic part, and some software development and implication. We dismantled the old system in the three towers of the parabolic dishes. The old hour angle drive is shown in Figure 1.

The new hour angle drive system (Drehstrom – Flachgetriebe Motor) is mounted on a new support table in the aerial towers (Figure 2a). The new rectascension axle drive (Drehstrom – Kegelradgetriebe Motor) is mounted directly on the aerial screen carrier (arrow B in Figure 3). The electric engines are powered by a computer-controlled frequency-agile system (Figure 2b).

With this system a smooth and continuous change of the aerial motion at different speeds is possible. The actual aerial position is monitored by digitally coded angular measurement. Due to discrete radio sources on the extended solar disc an active drive control is not possible in the given frequency range and for the necessary full-disc observations. The information transfer from the position detectors to the computer and the drive unit is carried out using fiber optics to exclude

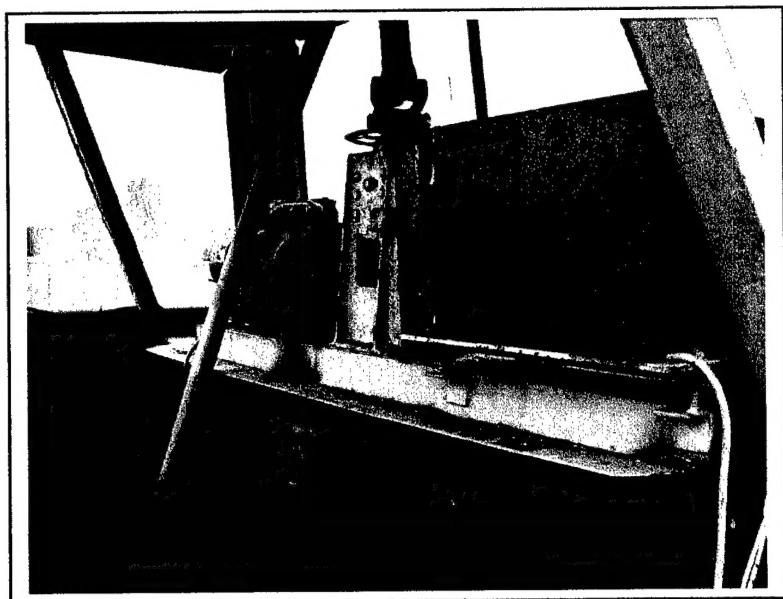


Fig. 1: The old drive for the hour axle

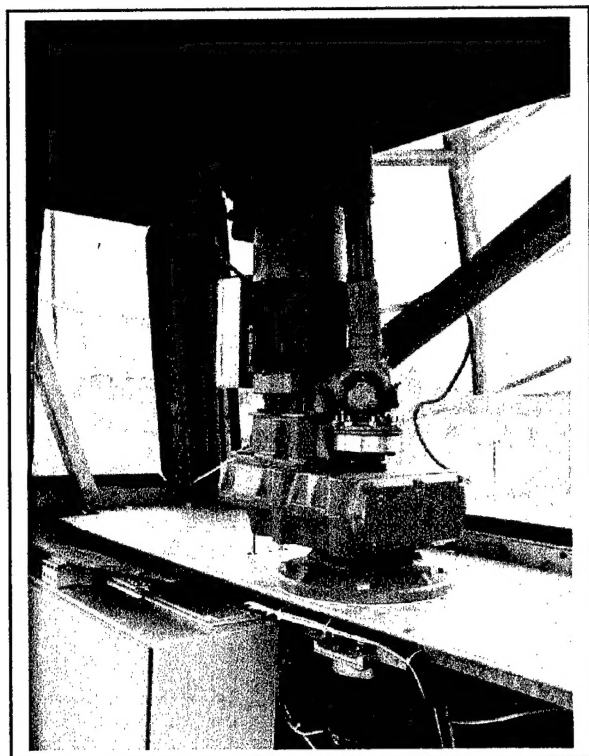


Fig.2a: The new "Drehstrom – Flachgetriebemotor" for the hour axle.

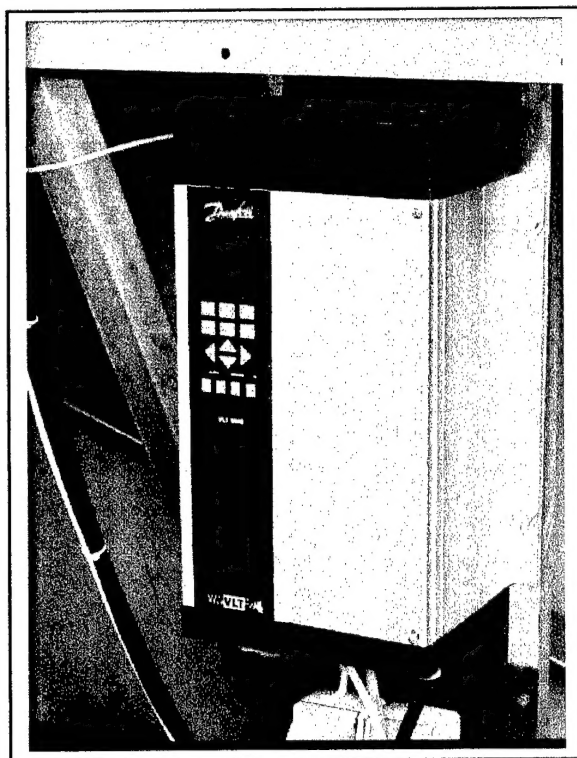


Fig. 2b: The new "Frequenzumrichter und Motorsteuerung"

thunderstorm (induction related) disturbances on long wires. Such effects frequently led to damages of the old control system and corresponding interruptions of the observations in the years before the upgrade.

During the work it turned out that for the electric installation network a new junction box is necessary. This was installed independently of the project and paid by the AIP. The use of the overall project expenses is summarized in the Table below.

Project Expenses

From the overall contract money (30 k\$) the following bills were paid. Differences due to the change of the \$ - € transfer rate were compensated by the AIP.

| Representative | Bill | Amount (€) | Subject |
|------------------|---------------------|-------------|------------------------|
| Digi Table | 19.02.02 (02/0121) | 2.191,99 | Frequenz – Umrichter |
| Digi Table | 07.03.02 (02/0279) | 7.371,81 | Drehstrommotore |
| Mueller Saarmund | 01.11.02 (02 / 136) | 3.931,98 | construction |
| Mueller Saarmund | 16.10.03 (03 / 109) | 3.931,98 | construction |
| Klein Groedersby | 17.05.02 (1170502) | 6.268,64 | electronics / software |
| Klein Groedersby | 18.06.03 (1180603) | 3.424,32 | electronics / software |
| Klein Groedersby | 28.08.03 (1280803) | 3.134,32 | electronics / software |
| Klein Groedersby | 09.10.03 (1091003) | 3.134,32 | electronics / software |
| Σ | | 33.389,36 € | |

In Figure 3 we show the new state of one of the parabolic aerals, the tower door is open. A – D mark the newly installed components.

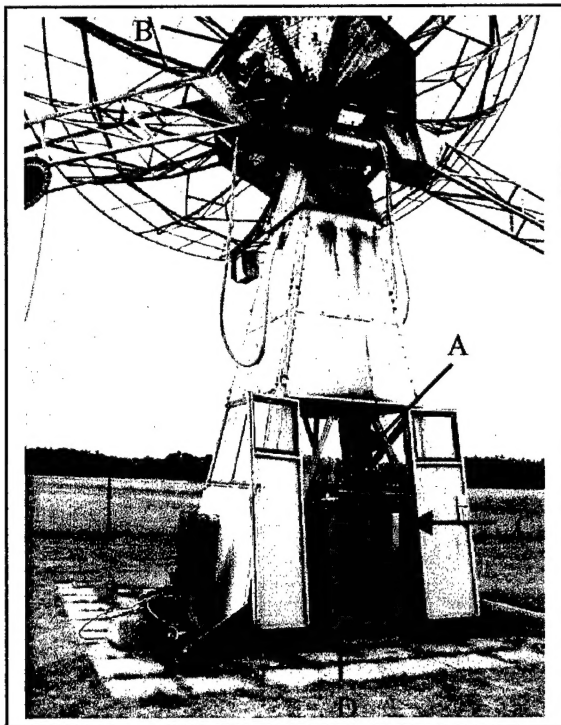


Fig. 3:

Global view of the aerial tower of a 7,5 m diameter system

A – Hour axle drive (Fig. 2a)

B – Rectascension drive
("Kegelradgetriebe-Motor")

C – Frequenzumrichter und
Motorsteuerung

D – new main junction box

The new system is more stable in the remotely controlled service. It is unified for all aerials, and it is fully included in the automatic computer control of the observing regime, a web page online solar radio spectral report inclusive. We expect that in the future work it is much easier to sustain the necessary continuous stream of data for the solar radio burst patrol. After achieving more continuity in the observations we will obtain a higher cross-data coverage with other observations and with other relevant data e.g. in the frame of the program "Living with a Star", or for cross reference with space based activity monitoring in other spectral ranges (GOES, SOHO, RHESSI, SMEI, STEREO, SOLAR B).

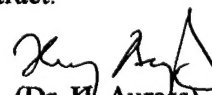
Conclusion

Thanks to the support of the project by EOARD we were able to obtain an improvement and stabilization of the the regular supervision of the meter and decimeter solar radio burst spectrum. This is a solid foundation of a continued cooperation between the AIP coronal physics group and the AFGRL.

Declarations

The contractor, Dr. Henry Aurass, hereby declares that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. F61775-01-WE094 is complete, accurate, and complies with all requirements of the contract. I certify that there were no subject inventions to declare as defined in FAR 52227-13, during the performance of this contract.

Date : 01 December 2003


(Dr. H. Aurass)
- Principal Investigator -